

FORM PTO-1390

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE
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107 069294

INTERNATIONAL APPLICATION NO.:
PCT/EP00/08181

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22 AUGUST 2000 (22.08.00)

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26 AUGUST 1999 (26.08.99)

TITLE OF INVENTION: MULTI-LAYER SLAB PRODUCT MADE OF STONE GRANULES AND RELATIVE MANUFACTURING PROCESS

APPLICANT(S) FOR DO/EO/US: Alessandro GODI and Pierpaolo TASSONE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
 2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
 3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
 4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
 5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau. (see attached copy of PCT/IB/308)
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
 6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
 7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
 8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
 9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
 10. ☐ A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
- Item 11. to 16. below concern document(s) or information included:
11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
 12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
 13. ☒ A **FIRST** preliminary amendment.
 - ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
 14. ☐ A substitute specification.
 15. ☐ A change of power of attorney and/or address letter.
 16. ☒ Other items or information: INTERNATIONAL PRELIMINARY EXAMINATION (PCT/IPEA/409), INTERNATIONAL SEARCH REPORT (PCT/ISA/210), APPLICATION DATA SHEET, ABSTRACT

U.S. APPLICATION NO. (if known) 107 069292		INTERNATIONAL APPLICATION NO. PCT/EP00/08181		ATTORNEY'S DOCKET NO. 2503-1004	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$ 1,040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$ 890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$ 740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$ 710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$ 100.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	130.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	9 - 20 =	0	X \$18.00	\$	
Independent claims	1 - 3 =	0	X \$84.00	\$	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ \$280.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$	1020.00
Reduction of 1/2 for filing by small entity, if applicable. Applicant claims Small Entity Status under 37 CFR 1.27.				\$	
SUBTOTAL =				\$	1020.00
Processing fee of \$130 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$	1020.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$	
TOTAL FEES ENCLOSED =				\$	1020.00
				Amount to be refunded:	
				charged:	
a.	<input checked="" type="checkbox"/>	A check in the amount of \$1020.00 to cover the above fees is enclosed.			
b.	<input type="checkbox"/>	Please charge my Deposit Account No. 25-0120 in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.			
c.	<input checked="" type="checkbox"/>	The Commissioner is hereby authorized to charge any additional fees which may be required by 37 CFR 1.16 and 1.17, or credit any overpayment to Deposit Account No. 25-0120 . A duplicate copy of this sheet is enclosed.			
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			February 25, 2002 By <u><i>Benoit Castel</i></u> Benoit Castel Attorney for Applicant Registration No. 35,041		

PATENT
2503-1004

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of: Alessandro GODI et al.

Appl. No.: **NEW NATIONAL PHASE
APPLICATION IN THE
UNITED STATES** Group:

Filed: February 25, 2002 Examiner:

For: MULTI-LAYER SLAB PRODUCT MADE OF STONE
GRANULATES AND RELATIVE MANUFACTURING
PROCESS

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

February 25, 2002

Sir:

Prior to the first Official Action and calculation of the filing fee, the following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

IN THE ABSTRACT OF THE DISCLOSURE:

Please replace the Abstract of the Disclosure with the rewritten Abstract of the Disclosure attached on a separate sheet attached hereto.

IN THE SPECIFICATION:

Page 3

Please add the following paragraph before the paragraph beginning on page 3, line 11:

-- FR-A-2.136.862 discloses a structure wherein an expanded, lightweight layer is directly bound by high temperature treatment to a surface layer having the same chemical composition of the expanded layer. No binding phase is accordingly present and this entails that the layers have to consist of the same material (silicate) so that chemical bonds can be formed during the high temperature vitrification/sinterization treatment.

US-A-4, 107,378 discloses a method and apparatus for manufacturing thin, flat lining plates having a two-layer structure. This document gives no teaching for obtaining a multi-layer structure different from the one described therein.--

Please replace the paragraph beginning on page 3, line 16, with the following rewritten paragraph:

This objective is obtained, according to the invention, by means of a product which shows the characteristics of the attached independent claim 1 and by a procedure which presents the characteristics of the attached independent claim 6.

Please replace the paragraph beginning on page 3, line 21, with the following rewritten paragraph:

Mainly, the product according to the invention, has two surface layers obtained by vibro-compression, consisting of an agglomerate, for example obtained from marble powder chips bound by polyester resin, and a precast support, for example obtained again by vibro-compression under vacuum, consisting of chips of expanded clay bound by polyester resin.

Page 5

Please delete the paragraph beginning on page 5, line 4.

IN THE CLAIMS:

Please substitute claims 1-10 as originally filed, which appear on pages 7 & 8, with claims 1-9 as filed in the Article 34 amendment of November 14, 2001. The pages containing claims 1-9 are marked "AMENDED SHEET" and are attached hereto. Following the insertion of claims 1-9, please amend the claims as follows:

Please amend the claims as follows:

4. (Amended) Multi-layer composite product according to claim 1, wherein said layer of stone material (3, 30) is

obtained by vibro-compression, optionally under vacuum, of marble powder or chips bound with polyester resin.

5. (Amended) Multi-layer composite product according to claim 1, wherein said precast support layer (2) is obtained by vibro-compression under vacuum of granules of expanded clay bound with polyester resin.

6. (Amended) A process for the preparation of a multi-layer composite slab product, according to claim 1, comprising the following steps:

- distribution of a stone material agglomerate together with a binding agent (3) in a mold or on a molding belt to form a first, lower layer of the product;

- positioning on said first layer of at least one pre-cast support (2) made of expanded agglomerate and a binding agent to form an intermediate layer of the product;

- distribution of a further stone material agglomerate together with a binding agent (3) on said at least one pre-cast layer (2) to form at least a second, upper layer of the product;

- vibro-compression, in a single step, of said stone material agglomerates and binding agent (3) and of said at least one pre-cast support (2);

- hardening of the mixture via thermal reaction;

- surface and perimetral finishing of the mold product, as desired.

8. (Amended) A process according to claim 6, wherein said at least one precast support (2) is previously obtained by vibro-compression under vacuum from expanded clay granules bound with polyester resin.

9. (Amended) Use of a product of claim 1 for the manufacture of floorings, internal walling and external cladding of residential and public buildings, and of furniture components.

REMARKS

Claims 4-6 and 8-9 have been amended to eliminate multiple dependencies.

The present amendment merely places this national phase application in the same condition as it was during Chapter II of the International Phase.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON



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BC/ma
Attachments

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE ABSTRACT OF THE DISCLOSURE:

The Abstract of the Disclosure has been amended as follows:

Abstract of the Disclosure

~~The invention concerns a~~ product and the relative manufacturing process, ~~said~~the product, ~~including~~includes at least a precast support (2) of expanded material and at least a layer (3) of agglomerated stone material in form of granulates bound by a binding phase, over at least one surface of ~~said~~the expanded support (2). According to suitability, the product (1) is made by a sandwich structure with an intermediate layer of expanded material and two surface coatings of stone material. The product (1) can also have a complex or modular shape, from which it is possible to cut and eventually to work finished pieces of predetermined dimensions. The main advantage of the invention consists in obtaining a finished product (1, 10, 100) lighter than a product made of agglomerated stones homogeneous in the thickness.

IN THE SPECIFICATION:

Page 3

The paragraph beginning on page 3, line 16, has been amended as follows:

This objective is obtained, according to the invention, by means of a product which shows the characteristics of the attached independent claim 1 and by a procedure which presents the characteristics of the attached ~~dependent claim 8.~~ independent claim 6.

The paragraph beginning on page 3, line 21, has been amended as follows:

Mainly, the product according to the invention, has at ~~least a surface layer~~ two surface layers obtained by vibro-compression, consisting of an agglomerate, for example obtained from marble powder chips bound by polyester resin, and a precast support, for example obtained again by vibro-compression under vacuum, consisting of chips of expanded clay bound by polyester resin.

IN THE CLAIMS:

The claims have been amended as follows:

4. (Amended) Multi-layer composite product according to ~~any one of the previous claims,~~ claim 1, wherein said layer of stone material (3, 30) is obtained by vibro-compression,

optionally under vacuum, of marble powder or chips bound with polyester resin.

5. (Amended) Multi-layer composite product according to ~~any one of the previous claims,~~claim 1, wherein said precast support layer (2) is obtained by vibro-compression under vacuum of granules of expanded clay bound with polyester resin.

6. (Amended) A process for the preparation of a multi-layer composite slab product, according to ~~anyone of the previous claims,~~claim 1, comprising the following steps:

- distribution of a stone material agglomerate together with a binding agent_(3) in a mold or on a molding belt to form a first, lower layer of the product;

- positioning on said first layer of at least one pre-cast support (2) made of expanded agglomerate and a binding agent to form an intermediate layer of the product;

- distribution of a further stone material agglomerate together with a binding agent (3) on said at least one pre-cast layer (2) to form at least a second, upper layer of the product;

- vibro-compression, in a single step, of said stone material agglomerates and binding agent (3) and of said at least one pre-cast support (2);

- hardening of the mixture via thermal reaction;
- surface and perimetral finishing of the mold product,

as desired.

8. (Amended) A process according to claim 6-~~or~~ 7, wherein said at least one precast support (2) is previously obtained by vibro-compression under vacuum from expanded clay granules bound with polyester resin.

9. (Amended) Use of a product of ~~claims 1-5~~ claim 1 for the manufacture of floorings, internal walling and external cladding of residential and public buildings, and of furniture components.

Abstract of the Disclosure

A product and the relative manufacturing process, the product, includes at least a precast support (2) of expanded material and at least a layer (3) of agglomerated stone material in form of granulates bound by a binding phase, over at least one surface of the expanded support (2). According to suitability, the product (1) is made by a sandwich structure with an intermediate layer of expanded material and two surface coatings of stone material. The product (1) can also have a complex or modular shape, from which it is possible to cut and eventually to work finished pieces of predetermined dimensions. The main advantage of the invention consists in obtaining a finished product (1, 10, 100) lighter than a product made of agglomerated stones homogeneous in the thickness.

1/p₁t₂

MULTI-LAYER COMPOSITE SLABS PRODUCT MADE OF STONE
GRANULATES AND RELATIVE MANUFACTURING PROCESS

The present invention concerns a product in multi-layer composite slabs made of agglomerated stone materials and its relative manufacturing process.

5 The always greater difficulties and the growing cost necessary to obtain blocks or slabs of natural (such as marble, granite, etc.) or artificial (for example of ceramic type) stone materials by quarrying and subsequent manufacturing process, have suggested a technology to manufacture artificially such stone blocks, using granulates coming from these materials bound together by a binder which can be of inorganic type, and so belonging to the class of cement binders, or of organic type, being in this case a synthetic resin which can be cured by a chemical or thermal
10 process.

According to this already known technology, the mixture made of stone chips, in selected grain size and therefore of predetermined dimensions of the granulates or chips (from a maximum of 150 mm to powder size) and of binder (in addition to other additives, such as mixture reology modifiers or curing or adhesion promoters)
15 is powdered in a mold and subjected to a process which mainly consists in the molding by vibro-compression, i.e. simultaneous applying of a compacting pressure and of a vibration, both these phases under a predetermined vacuum, in order to avoid air entrapment into the mixture.

After the vibro-compression under vacuum phase, the mixture is left to rest into
20 the mold until the resin is completely cured (by addition of a suitable promoter) or the cement is hardened, binding irreversibly the granulates of stone material in a single block.

Alternatively, avoiding the use of a mold, the mixture can be fed, according to convenience, on a molding belt, so assuming the shape of a slab, which after vibro-
25 compression and subsequent hardening does not need the sawing phase.

In this case the resin curing is obtained by a thermal reaction, warming the product, which hardens in a few minutes.

The manufacturing process is more convenient than the block molding technology and the production cycles are advantaged. Due to the fact that the
5 sawing phase is not necessary, the slab, after the hardening phase, can be immediately supplied to the final working phase.

The resulting products show mechanical properties which make them particularly suitable, after the necessary working phases, for the manufacture of floorings, internal walling and external cladding of residential and public buildings,
10 and of furniture components.

When a synthetic resin is used as binder, one of the main advantages is that the hardening phase requires very short time and the mechanical properties of the product are better than those of the corresponding cement bound products.

The disadvantage connected with the use of a synthetic resin is the high price of
15 the resin, so that, also if it is used in a relatively small amount, the cost of a resin bound product is always high. On the contrary, when a cement binder is used, the main problem, in an industrial production, is connected with the long time required by the set and the subsequent hardening. Moreover, the final product is heavy, since high thickness must be used due to the poor mechanical resistance when compared
20 to the resin bound products, mainly in the phase of installation as outdoor wall finishes.

Besides to these general aspect problems, there are other problems specifically connected to specific applications.

In the case of products for the manufacturing of components for furniture, for
25 example, the high weight of the element represents a disadvantage both from the commercial, for the elevated transport cost, and from the performance point of view, for the difficulty of the installation.

In fact, a typical formulation for the production of agglomerated stones using

the technology of the vibro-compressure under vacuum, for example in the more favourable case of use of polyester resin as binder, could comprise:

- 92% by weight of granulates and marble powder
- 8% by weight of polyester resin.

Due to the fact that the granulates or the marble powder have an average specific weight of 2.7 kg/dm^3 , and the polyester resin has an average specific weight of 1.1 kg/dm^3 , the resulting product, for example in the size of 1 m^2 and 3 cm thickness, will have a theoretical specific weight of 2.57 kg/dm^3 (slightly higher than the experimental value which generally ranges between $2.49\text{-}2.50 \text{ kg/dm}^3$) corresponding to a weight of 77.1 kg , which is too high in view of what mentioned.

< INSERT PAGE 3A >

Object of the invention is mainly to avoid the disadvantage of the high weight of the products made of stone chips, manufactured by the technology of the vibro-compressure under vacuum, making a product noticeably lighter and which maintains substantially the technical and aesthetical properties of the above mentioned products.

This objective is obtained, according to the invention, by means of a product which shows the characteristics of the attached independent claim 1 and by a procedure which presents the characteristics of the attached ~~dependent~~ ^{INDEPENDENT} claim ~~8~~ ⁶.

Advantageous applications of the present invention are shown in the dependent claims.

Mainly, the product according to the invention, has ~~at least~~ ^{TWO} surface ~~layer~~ ^{LAYERS} obtained by vibro-compressure, consisting of an agglomerate, for example obtained from marble powder chips bound by polyester resin, and a precast support, for example obtained again by vibro-compressure under vacuum, consisting of chips of expanded clay bound by polyester resin.

Preferably, the product according to the invention has a sandwich structure, where the expanded clay precast support makes up the intermediate layer, and two surface layers of agglomerate provided, one on the top and one under the

3A

FR-A-2.136.862 discloses a structure wherein an expanded, lightweight layer is directly bound by high temperature treatment to a surface layer having the same chemical composition of the expanded layer. No binding phase is accordingly present and this entails that the layers have to consist of the same material (silicate) so that chemical bonds can be formed during the high temperature vitrification/sinterization treatment.

US-A-4,107,378 discloses a method and apparatus for manufacturing thin, flat lining plates having a two-layer structure. This document gives no teaching for obtaining a multi-layer structure different from the one described therein.

intermediate layer.

It has been experimentally shown that an agglomerate of expanded clay bound by polyester resin can reach a specific weight lower than 1 kg/dm^3 .

5 Therefore, a laminated composite product, with a sandwich structure according to the invention, 1 m^2 of a size and 3 cm in thickness, as in the example above described, containing an upper surface layer and a lower surface layer, both of them of 0.5 cm of agglomerated marble, and an intermediate layer of 2 cm of agglomerated expanded clay, will have a total weight of 45.7 kg.

10 Such a product results therefore noticeably lighter than a product with the same dimensions, made of agglomerated stone but homogeneous in thickness.

The product in multi-layer composite slabs, according to the invention, can also be realised with at least a perimetral edge, suitably shaped, in stone material.

15 Advantageously, the product according to the invention can also be manufactured in form of complex element comprising a plurality of modular elements with a sandwich structure, connected each other by layers of stone chips material, in order that the single moduli can be, when necessary, separated one from the other by cutting and optionally finished to obtain the wished edge shape.

20 Further characteristics of the invention will be evident from the following description, referred to embodiments given by way of an example, shown in the attached figures, where:

- fig.1 is an axonometric schematic view of a product with a sandwich structure according to the invention;
- fig.2 is a view in partial section of the product shown in fig.1, but with a lateral edge in stone chip material;
- 25 • fig.3 is a view in axonometry of a complex or modular product, from which it is possible, for example, to obtain by cutting and subsequent finishing, single or edged elements, such as that shown in fig.2.

Fig.1 shows a product (1) according to the invention, having a sandwich

structure, including an intermediate layer as support (2) with a relatively low specific weight, (e.g. consisting of expanded clay), and two surface layers, upper and lower, indicated with the same reference number (3), consisting of stone chips.

~~Optionally, the product (1) could comprise only the expanded clay support (2) and the upper layer (3) in stone material~~

The product (1) of fig.1 is obtained, according to convenience, by the technique of vibro-compression under vacuum. Particularly, the intermediate layer is a precast of expanded clay chips bound with polyester resin obtained by the above mentioned technique of vibro-compression under vacuum, on the upper and lower surfaces of which, the surface layers (3) consisting of an agglomerate, for example obtained from marble powder chips bound with polyester resin, are mold, e.g. by said vibro-compression method.

Due to the fact that the larger part of the product (1) thickness is occupied by the intermediate layer in expanded clay (2), the total weight of the product results noticeably lower than the weight of a product of corresponding size made of agglomerated stone, homogeneous in thickness, as clearly shown in the above mentioned example.

The product (10) of fig.2 differs from that of fig.1 for the presence of a lateral edge (30) in the same stone material of the surface layers (3).

Fig.3 schematically shows a complex product (100) of modular type, containing a plurality of intermediate layers (2) in expanded clay, regularly positioned and completely immersed in the agglomerated stone (3), which distributes therefore also in the spaces among the supports (2).

In this way, it is possible to obtain a modular product, from which it is possible to cut elements with the wished number of moduli, both in the longitudinal and the transverse direction sense, according to the needs.

The slab cut following some of the shaded lines in fig.3 can be subsequently finished to obtain for example the edging (30) shown in fig.2.

structure, including an intermediate layer as support (2) with a relatively low specific weight, (e.g. consisting of expanded clay), and two surface layers, upper and lower, indicated with the same reference number (3), consisting of stone chips.

Optionally, the product (1) could comprise only the expanded clay support (2) and the upper layer (3) in stone material.

The product (1) of fig.1 is obtained, according to convenience, by the technique of vibro-compression under vacuum. Particularly, the intermediate layer is a precast of expanded clay chips bound with polyester resin obtained by the above mentioned technique of vibro-compression under vacuum, on the upper and lower surfaces of which, the surface layers (3) consisting of an agglomerate, for example obtained from marble powder chips bound with polyester resin, are mold, e.g. by said vibro-compression method.

Due to the fact that the larger part of the product (1) thickness is occupied by the intermediate layer in expanded clay (2), the total weight of the product results noticeably lower than the weight of a product of corresponding size made of agglomerated stone, homogeneous in thickness, as clearly shown in the above mentioned example.

The product (10) of fig.2 differs from that of fig.1 for the presence of a lateral edge (30) in the same stone material of the surface layers (3).

Fig.3 schematically shows a complex product (100) of modular type, containing a plurality of intermediate layers (2) in expanded clay, regularly positioned and completely immersed in the agglomerated stone (3), which distributes therefore also in the spaces among the supports (2).

In this way, it is possible to obtain a modular product, from which it is possible to cut elements with the wished number of moduli, both in the longitudinal and the transverse direction sense, according to the needs.

The slab cut following some of the shaded lines in fig.3 can be subsequently finished to obtain for example the edging (30) shown in fig.2.

The advantages are evident from the above description, the scope of the invention being determined by the content of the annexed claims.

EXAMPLE

An example of manufacturing process of a product according to the invention typically includes the following phases:

- molding by vibro-compression under vacuum of a block made of expanded clay chips, of a selected grain size, bound by the minimum requested amount of polyester resin;
- hardening of the block via a chemical reaction by curing at room temperature;
- sawing of the block in slabs of predetermined thickness and subsequent slab surface gauging;
- perimetral finishing of the agglomerated slabs in expanded clay for working them, if requested, to the wished shape;
- mixing of a mixture of stone chips in the selected grain size, powder and binder in the typical proportions required for the manufacturing of an agglomerate (the stone chips can be suitable made of marble, granite, quartz, or other inert materials);
- distribution of the required amount of mixture on a molding belt, to mold the first lower layer of the composite;
- positioning, according to convenience, of expanded clay over this first layer of the slab;
- distribution on the slab of expanded clay of a further amount of mixture, suitable to make the upper layer of the composite;
- molding by vibro-compression under vacuum, in a single step, of the layers of the prepared composite;
- hardening of the mixture via thermal reaction;
- surface and perimetral finishing of the mold product, as desired.

CLAIMS

1. Multi-layer composite slab product, comprising at least one support layer (2) consisting of expanded material agglomerate and a binding agent,
5 and a surface layer (3) consisting of stone material agglomerate and a binding agent, characterized in that said at least one support layer (2) is a pre-cast support layer and in that it is sandwiched between two of said surface layers (3) by vibro-compression, in a single step.
2. Multi-layer composite product according to claim 1, characterized by
10 further comprising a lateral edge (30) consisting of agglomerate of the same stone material and binding agent of said surface layers (3).
3. Multi-layer composite product according to claim 1, characterised by a composite or modular structure, with a plurality of support elements (2) of expanded material agglomerate and a binding agent, immersed in said stone
15 material agglomerate and binding agent (3).
4. Multi-layer composite product according to any one of the previous claims, wherein said layer of stone material (3, 30) is obtained by vibro-compression, optionally under vacuum, of marble powder or chips bound with polyester resin.
- 20 5. Multi-layer composite product according to any one of the previous claims, wherein said precast support layer (2) is obtained by vibro-compression under vacuum of granules of expanded clay bound with polyester resin.
6. A process for the preparation of a multi-layer composite slab product,
25 according to anyone of the previous claims, comprising the following steps:
 - distribution of a stone material agglomerate together with a binding agent (3) in a mold or on a molding belt to form a first, lower layer of the product;

- positioning on said first layer of at least one pre-cast support (2) made of expanded agglomerate and a binding agent to form an intermediate layer of the product;
- distribution of a further stone material agglomerate together with a binding agent (3) on said at least one pre-cast layer (2) to form at least a second, upper layer of the product;
- vibro-compression, in a single step, of said stone material agglomerates and binding agent (3) and of said at least one pre-cast support (2);
- hardening of the mixture via thermal reaction;
- surface and perimetral finishing of the mold product, as desired.

7. A process according to claim 6, wherein a plurality of pre-cast supports (2) are provided, immersed in said stone material agglomerates.

8. A process according to claim 6 or 7, wherein said at least one precast support (2) is previously obtained by vibro-compression under vacuum from expanded clay granules bound with polyester resin.

9. Use of a product of claims 1-5 for the manufacture of floorings, internal walling and external cladding of residential and public buildings, and of furniture components.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 March 2001 (01.03.2001)

PCT

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ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: MULTI-LAYER SLAB PRODUCT MADE OF STONE GRANULATES AND RELATIVE MANUFACTURING PROCESS

(57) Abstract: The invention concerns a product and the relative manufacturing process, said product, including at least a precast support (2) of expanded material and at least a layer (3) of agglomerated stone material in form of granulates bound by a binding phase, over at least one surface of said expanded support (2). According to suitability, the product (1) is made by a sandwich structure with an intermediate layer of expanded material and two surface coatings of stone material. The product (1) can also have a complex or modular shape, from which it is possible to cut and eventually to work finished pieces of predetermined dimensions. The main advantage of the invention consists in obtaining a finished product (1, 10, 100) lighter than a product made of agglomerated stones homogeneous in the thickness.

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Fig. 1

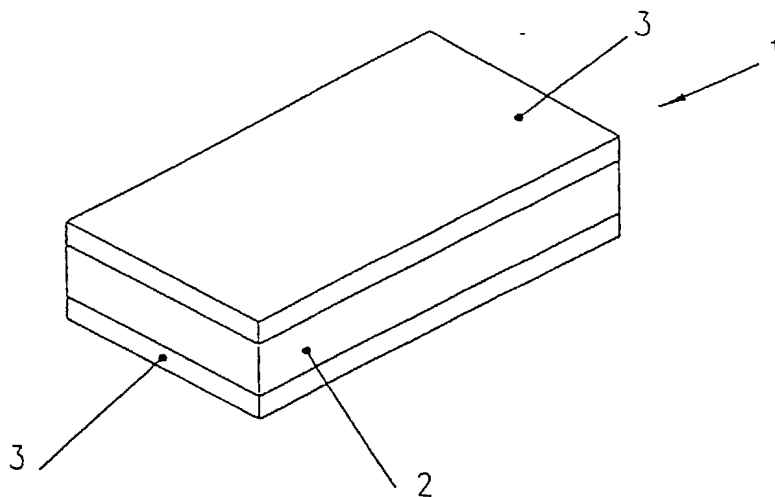


Fig. 2

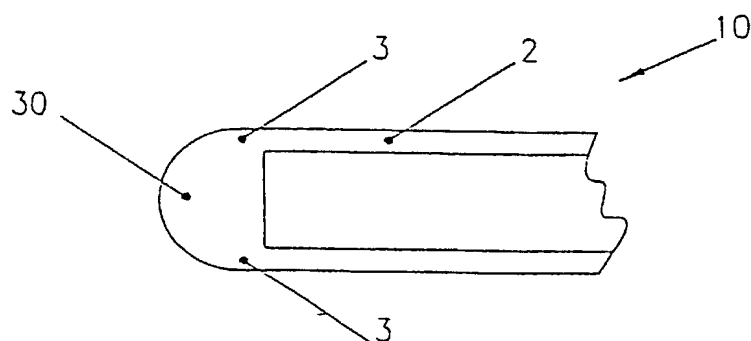
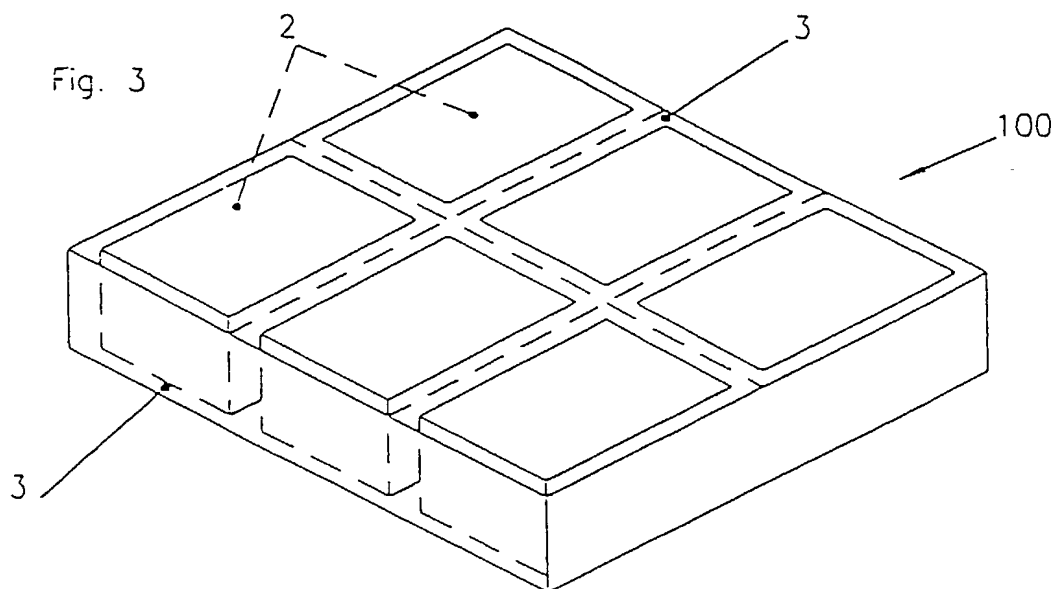


Fig. 3



Ref.

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Multi-layer slab product made of stone granulates and relative manufacturing process

the specification of which: *(check one)*

REGULAR OR DESIGN APPLICATION

- [] is attached hereto.
- [] was filed on _____ as application Serial No. _____ and was amended on _____ (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

- was described and claimed in International application No. PCT/EP00/08181 filed on 22.08.2000 and as amended on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

PRIORITY CLAIM

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

Country	Application Number	Date of Filing (day, month, year)	Priority Claimed
Italy	MI99A001835	26.08.1999	YES

(Complete this part only if this is a continuing application.)

I hereby claim the benefit under 35 USC 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)

(Filing Date)

(Status--patented, pending, abandoned)

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The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from _____ as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

As a named inventor, I hereby appoint the following attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Robert J. PATCH, Reg. No. 17,355, Andrew J. PATCH, Reg. No. 32,925, Robert F. HARGEST, Reg. No. 25,590, Benoît CASTEL, Reg. No. 35,041, Eric JENSEN, Reg. No. 37,855, and Thomas W. PERKINS, Reg. No. 33,027, c/o YOUNG & THOMPSON, Second Floor, 745 South 23rd Street, Arlington, Virginia 22202.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's signature _____ Date _____

Residence: _____ Citizenship: _____

Post Office Address: _____